



**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10**

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OFFICE OF
ENVIRONMENTAL CLEANUP

September 4, 2014

Mr. Bob Wyatt
NW Natural
220 NW 2nd Avenue
Portland OR 97209

sent via email only

Mr. Myron Burr
Siltronic Corporation
7200 NW Front Avenue, M/S 20
Portland, Oregon 97210-3676

Re: Response to EPA Comments on Gasco Sediments Site – Distributed Temperature Sensing Work Plan

Dear Sirs:

This letter serves as a response to the response to comments letter and revised Distributed Temperature Sensing Work Plan (Work Plan), both dated August 25, 2014, for the Gasco Sediments Site. The letter and Work Plan were prepared by Anchor QEA, LLC (Anchor QEA) on behalf of NW Natural. EPA's responses to the Work Plan comment responses are attached.

EPA acknowledges NW Natural's notification provided on August 29, 2014 that NWN would like to commence implementation of the Work Plan on September 15, 2014 by initiating the deployment of the Distributed Temperature Sensing (DTS) cable. EPA provides conditional approval for this request pending receipt of acceptable responses to the attached comment response review as well as a final revision to the Work Plan. We ask that the requested information be provided by end of day September 9, 2014 and include red line strike out revisions so that EPA and its partners have time to review for adequacy and respond.

Please let me know if you would like to discuss this letter further, or have any questions or concerns at (206) 553-1220 or via email at sheldrake.sean@epa.gov.

Sincerely,

A handwritten signature in blue ink, appearing to read "SS", followed by a long horizontal line.

Sean Sheldrake, RPM

Cc:

Kristine Koch, EPA
Lance Peterson, CDM/S
Dana Bayuk, ODEQ

via email only

EPA Comments on Response to EPA Comments on Gasco Sediments Site – Distributed Temperature Sensing Work Plan

Dated August 25, 2014

The following are U.S. Environmental Protection Agency (EPA) comments on the *Response to EPA Comments on Gasco Sediments Site – Distributed Temperature Sensing Work Plan* letter prepared by Anchor QEA, LLC (Anchor QEA) on behalf of NW Natural. EPA's original comments are presented, followed by NW Natural's responses in italics which are followed by EPA's response review.

EPA Comment 1—Introductory Paragraph and Objective, Pages 1 – 2

The Work Plan provides confusing information regarding the objective of the proposed investigation. The last sentence in the 1st paragraph states that, "The purpose of this Work Plan is to describe a proposed field investigation for identifying areas of groundwater discharge and recharge in the Willamette River adjacent to the Gasco Sediment Site to support the evaluation of remedial technologies required by the AOC." The last sentence in the "Objectives" section states that, "If the collected data is helpful in evaluating remedial effectiveness of different design scenarios in the target area, NW Natural may decide to propose implementation of this technology in other portions of the Project Area."

Given the limited size of and location of the survey area proposed in the Work Plan, EPA believes the proposed temperature survey represents an initial assessment of the distributed temperature sensing (DTS) technology and its potential use in the Gasco Sediments Site. Consistent with information in the Work Plan, we further understand use of the DTS technology will support selection of seepage meter locations to further quantify groundwater flux to/from the river and for collection of transition-zone water samples for analysis. The Work Plan should confirm, clarify, or correct these understandings.

NW Natural Response to Comment 1

The objective of using the DTS technology is to provide data to support the evaluation of remedial alternatives for the Gasco Sediments Site as described in the Introduction to the Work Plan. Rather than propose implementation of this investigation technology over a broad area, NW Natural proposed a focused investigation to demonstrate the effectiveness of the DTS technology for identifying groundwater seepage areas with greater spatial and temporal resolution compared to previously used investigative techniques. If the technology proves to be suitable for the conditions at the Gasco Sediments Site, then additional investigation (which may involve investigating a broader area, different times of year and hydrologic conditions, longer timeframes, or a combination of some or all of these factors) may be proposed as necessary to further support evaluation of remedial alternatives.

The DTS technology is not being used to select the locations of additional seepage meters at the Gasco Sediments Site. The Work Plan referenced DTS results on another project simply to provide EPA with an example to show that this technology has been effectively used on EPA-managed sites to support remedial design evaluations.

No revisions were made to the Work Plan based on this EPA comment.

EPA Response to NW Natural Response to Comment 1

While NW Natural does not directly respond to the comment, based on the information provided, EPA continues to understand that under the circumstances and given the scope of work the current field deployment is a DTS technology demonstration/evaluation. Please clarify if needed, otherwise no further response is necessary.

EPA Comment 2—Objective, Page 1

The Work Plan mentions a groundwater model developed during development of the Draft Engineering Evaluation/Cost Analysis (EE/CA) Report and EPA's EE/CA comment request for the predictions of flow reversal to be further evaluated. This appears to be the basis for NW Natural's preparation of the Work Plan. However, background and supporting information regarding this model were not provided in the Draft EE/CA Report. Comments on the Draft EE/CA Report requested information regarding the model, including but not limited to model documentation to support the gradient reversal figure included in the report (see EE/CA Figure 2.3.1.1-1). To date this information has not been provided. Without information being provided about the model, it is unclear what specific data needs NW Natural intends the Work Plan to address.

NW Natural Response to Comment 2

Anchor QEA submitted a letter to EPA on May 13, 2014 that proposed resolution of outstanding technical issues on the draft Engineering Evaluation/Cost Analysis (EE/CA), including the groundwater modeling comment noted above. EPA's response letter dated June 13, 2014, deferred resolution of this issue to a later time. No additional information was submitted to EPA regarding the groundwater model due to this EPA comment, but we can certainly provide the model documentation for EPA's review independent of the proposed DTS data collection.

As stated in Response to Comment 1, the objectives of the data collection are to demonstrate the effectiveness of the DTS technology for identifying groundwater seepage areas with greater spatial and temporal resolution than investigative techniques used previously. The focused investigation will provide a measure of site-specific groundwater seepage data in an area of the site where previous investigations found relatively elevated groundwater seepage. DTS data collection will begin with the upland hydraulic control and containment (HC&C) system shut down so that groundwater discharge is not impacted by groundwater extraction followed by data collection during system. These data collections will occur in an area where relatively elevated groundwater seepage was measured prior to operation of the HC&C system. This data collection will support future remedial alternatives evaluations at the Gasco Sediments Site.

No revisions were made to the Work Plan based on this EPA comment.

EPA Response to NW Natural Response to Comment 2

Based on NW Natural's response, EPA understands there may be two groundwater models being developed for use, one for source control and one for the in-water project. NW Natural should confirm, clarify, or correct this understanding. If there are indeed two models, NW Natural should explain the reason for developing two separate models.

EPA Comment 3—Objective Section, Page 2

The Work Plan states that if the collected data is helpful, then additional deployments of the DTS systems are envisioned in other portions of the Project Area. If known, please provide what additional portions of the Project Area are envisioned for deployment of the DTS system and how they would be selected.

NW Natural Response to Comment 3

NW Natural may propose additional investigations, if appropriate, after evaluating data from the focused investigation and comparing them with data previously collected using other methods. The results of the focused investigation and the rationale for any additional proposed investigation will be presented in the focused investigation results report identified in the Work Plan.

No revisions were made to the Work Plan based on this EPA comment.

EPA Response to NW Natural Response to Comment 3

EPA notes the last sentence on page 5 of the Work Plan under Proposed DTS Test Investigation states, “In accordance with the AOC requirements, the results of the DTS field investigation will be submitted to USEPA” and the last sentence of the Work Plan states, “Any proposed additional DTS investigations would be included in the DTS field investigation report”. EPA understands these sentences refer to the above-referenced “focused investigation results report” that will be produced at the completion of the DTS field investigation. Please clarify this understanding is correct.

EPA Comment 4—Previous Offshore Groundwater Investigations, Page 3

Based on information provided in previous submittals, it is understood that besides GCSEEP 7F and GS-B7SM, seepage meter data were collected at other seepage meter locations in the proposed DTS test area, including GCSEEP 7B, GS-C7SM, SLSEEP 2A, SLSEEP 2C, and SLSEEP 2E. The Work Plan should also discuss these seepage meters in the context of the proposed DTS test area.

NW Natural Response to Comment 4

The Work Plan incorrectly referred to location GCSEEP 7F. This location is farther offshore than the focused investigation area. The groundwater seepage rate noted in the Work Plan is associated with location GCSEEP 7B, which is near the center of the focused investigation area. This is the location where the greatest positive discharge (seepage) rate was observed in previous investigations. A tabular summary of the average seepage rate for all of the locations identified in the comment is provided below. The location proposed for the focused investigation is the nearshore area with the highest groundwater discharge rates observed in all previous groundwater seepage investigations (Offshore Investigation Report, Anchor Environmental 2008; Portland Harbor RI/FS Round 2 Groundwater Pathway Assessment Site Characterization Summary Report, Integral 2006).

Location ID	Average Seepage Rate (centimeters/day)	Location Relative to Proposed Focused Investigation Area
GCSEEP 7F	0.33	Farther offshore, adjacent to Gasco
GS-B7SM	1.43	Within proposed focused investigation area
GCSEEP 7B	5.67	Within proposed focused investigation area
GS-C7SM	1.76	Farther offshore, adjacent to Gasco
SLSEEP 2A	0.15	Farther upstream, adjacent to Siltronic
SLSEEP 2C	5.04	Farther upstream, adjacent to Siltronic
SLSEEP 2E	3.48	Farther upstream and offshore, adjacent to Siltronic

The Work Plan text and Figure 3 have been revised to correct the reference to the previous investigation location. The other locations identified in the comment are outside of the proposed focused investigation area and are therefore not discussed in the Work Plan.

EPA Response to NW Natural Response to Comment 4

The hydrograph for seepage meter “GS-B7” indicates that the seepage rate ranges between - 0.5 cm/day and 0.5 cm/day (see Figure 4.5, Offshore Investigation Report). The Offshore Investigation Report indicates that the mean seepage rate at this location is -0.5 cm/day (i.e., on average river recharges groundwater). NW Natural should provide the data to support the average seepage rate shown in the nested table provided in the response, including 1.43 cm/day and 5.67 cm/day at GS-B7SM and GCSEEP-7B, respectively. Alternatively, NW Natural should provide all relevant information for the seepage meter designated “GS-B7SM,” including location, river/seepage hydrograph, and data.

EPA Comment 5—Previous Offshore Groundwater Investigations, Page 3

An explanation should be provided of the time(s) of year the historical seepage readings are based on to provide context for the Lower Willamette Group and NW Natural seepage readings in comparison to the time of year the proposed testing will occur (see also Specific Comment 12).

NW Natural Response to Comment 5

The LWG seepage meter (locations GCSEEP 7B, GCSEEP 7F, SLSEEP 2A, SLSEEP 2C, and SLSEEP 2E) data collection was performed between August 1 and September 9, 2005. The NW Natural seepage meter (locations GS-B7SM and GS-C7SM) data collection was performed between October 2 and October 6, 2007. The plan was to perform the proposed focused investigation during the same time of year as the previous seepage measurements in order to optimize the comparative analysis of methods. Given the current timeframe for Work Plan approval and deployment of the fiber optic cable, data collection during the summer (when surface water temperature is sufficiently higher than groundwater temperature) may not be possible this year. However, winter measurements (when surface water is significantly cooler than groundwater) will provide reliable groundwater discharge data that can still be compared to the prior information. Based on the results of the focused investigation, NW Natural may propose to collect additional data during other hydrologic conditions when the river and groundwater temperatures are sufficiently different to be accurately differentiated by the DTS technology.

The Work Plan was revised to incorporate this information.

EPA Response to NW Natural Response to Comment 5

Response is acceptable.

EPA Comment 6—Previous Offshore Groundwater Investigations, Page 3

Available data for Seepage Meter GS-B7SM suggests that overall the river recharges groundwater at this location. Consequently, the survey appears to focus on an area where existing conditions support “gradient reversal” from the river to groundwater. The Work Plan should provide the basis for proposing the survey area shown in Figure 3, and discuss the potential limitations of the survey area location on DTS data collection, use, and interpretation.

NW Natural Response to Comment 6

As noted in the Response to Comment 4, the proposed location for the focused investigation is in the area where previous investigations identified the highest rates of groundwater discharge prior to operation of the upland HC&C system. The average discharge at location GS-B7SM is +1.43 cm/day and the average discharge at GCSEEP 7B is +5.25 cm/day (Anchor 2008 and Integral 2006).

The Work Plan was revised to more directly state that the focused investigation area is centered on previous seepage meter locations that contained the highest groundwater discharges measured at the Gasco Sediments Site.

EPA Response to NW Natural Response to Comment 6

See EPA Response to NW Natural Response to Comment 4.

EPA Comment 7—Proposed DTS Test Investigation, Pages 3 – 4

This section should include a description of how DTS cable placement will be verified spatially. For instance, a GPS device could be used to obtain coordinates of the anchor points.

NW Natural Response to Comment 7

Spatial verification will be performed through the collection of geographic coordinates at the cable anchor points using a differential global positional system (DGPS) device. If site conditions support installation of the fiber optic cable in straight lines between anchors as shown on Figure 3 in the Work Plan, surveying will be limited to the anchor points and some limited locations between the anchors. If the site conditions require non-linear installation in some areas, additional coordinates will be collected in those areas to accurately document the cable layout.

The Work Plan was revised to include more information regarding the collection of geographic coordinates along the cable configuration.

EPA Response to NW Natural Response to Comment 7

The text in the 2nd paragraph on Page 4 states: “Anchor points will be installed approximately at the locations shown in Figure 3.” No anchor points are apparent on Figure 3. The planned anchor points should be added to Figure 3.

EPA Comment 8—Proposed DTS Test Investigation, Page 3 – 4

Continuous readings of water elevation/temperature in the river and in a monitoring well near the shoreline opposite the test area would appear to be useful to support analysis of the DTS measurements. A discussion in the Work Plan as to how the analysis of DTS data will be carried out would be helpful.

NW Natural Response to Comment 8

Water level data are currently collected continuously by Anchor QEA at the Gasco dock and by the U.S. Geological Survey (USGS) at the Morrison Bridge. Anchor QEA also continuously monitors groundwater temperature in the existing wells and piezometers, including the PZ7 and PZ9 piezometers in the immediate vicinity of the focused investigation.

Surface water and groundwater temperature and level monitoring will continue throughout the focused investigation to support evaluation of the DTS data.

DTS data are evaluated through a combination of visualization and statistical tests following data calibration. The data are first corrected and adjusted for calibration. The data are then plotted and viewed in several ways to evaluate differences that could be due to confounding factors. Examples of such confounding factors may include unburied sections of cable (e.g., spanning debris or rock), temperature stratification of surface water, and solar heating of shallow sediment or exposed cable. Such factors can typically be corrected for and sections of cable can be omitted from data evaluation if necessary to minimize impacts by these factors. Once the data are calibrated and adjusted for such factors, the data are reviewed in contour plots and line plots, and statistical tests are run to evaluate the measured temperature differences.

The Work Plan was revised to include the additional information included in the response above.

EPA Response to NW Natural Response to Comment 8

NW Natural's response requires some clarification. The comment suggested continuous readings of water elevation/temperature in the river and in a monitoring well near the shoreline opposite the test area would appear to be useful to support analysis of the DTS measurements. The response states that water level data are currently collected continuously by Anchor QEA at the Gasco dock and by the U.S. Geological Survey (USGS) at the Morrison Bridge but makes no mention of surface water temperature measurements. A description should be provided of site-specific surface water temperature measurement locations including proximity to the DTS cable and how temperature stratification is monitored. Any necessary equipment calibration (e.g. temperature probes, DTS cable) to ensure data quality should also be described.

EPA Comment 9—Previous Offshore Groundwater Investigations, Page 3

The Work Plan indicates that the historic seepage meter data summarized for GS-B7SM and GCSEEP 7F do not consider operation of the upland hydraulic control and containment (HC&C) system. EPA currently understands that operation of the HC&C system is ongoing at low discharge rates to maintain water flow through water treatment system piping and equipment. Based on the location of the proposed survey area, operation of the HC&C system could result in unreasonable overestimates of recharge rates from the river to groundwater. The Work Plan should discuss the status of the HC&C system, including the current testing schedule and flow rates; and how this information will be incorporated into analysis of the DTS data.

NW Natural Response to Comment 9

DTS data collection will initially occur during a temporary shut-down of the HC&C system to allow temperature measurements in the absence of groundwater extraction. The duration of the temporary shutdown has not yet been determined, but optimally might last for a period of weeks. Following that period of data collection, the HC&C system would then be turned on and additional DTS data collection would occur for a period of weeks to months (duration dependent on findings). Depending upon the usability of the DTS data, it may be possible to use it for assessment of the HC&C system in the offshore area.

The Work Plan was revised to state that DTS data will initially be collected during shut down of the HC&C system shutdown and then subsequently during operation of the system.

EPA Response to NW Natural Response to Comment 9

A “temporary shut-down” of the HC&C system for “weeks” is inconsistent with information provided by NW Natural to EPA and the Oregon Department of Environmental Quality regarding the need for the HC&C system to maintain low flows for treatment system operations. The agencies feel this is the first time NW Natural has indicated the HC&C system may be shut-down for an extended period of time. NW Natural should provide the proposed HC&C system testing schedule in the context of the DTS Work Plan. We also repeat our request for information on the treatment system maintenance flow rates.

EPA Comment 10—Proposed DTS Test Investigation, Page 3 – 4

The Work Plan indicates the DTS cable will be buried in the upper 2 inches of sediment. The depth of the cable appears to be an especially important factor in collecting representative and usable data regarding the interaction(s) between groundwater and the river. Consequently, the Work Plan should fully explain the technical basis for this approach. In addition, if the DTS cable is intended to remain in the river for an extended period of time an explanation should be provided of any regular (diver?) inspections needed to ensure the cable remains buried/secured.

NW Natural Response to Comment 10

The precise depth of the cable is not critical to the measurement as long as the cable is embedded in the substrate and not directly exposed to the surface water. During installation, the diver will confirm that the cable is embedded (not exposed). After an extended period of inactivity (two or more months), a premeasurement check will be performed. This check will include turning the system on to evaluate any irregularities in the captured data that may be due to exposure of the cable. Depending on the results of this pre-measurement check, a diver may be used to check to ensure the cable is embedded. Similarly, during continuous operation of the system, the data will be evaluated for irregularities that may be due to exposure of the cable.

The Work Plan was revised to include the additional information included in the response above.

EPA Response to NW Natural Response to Comment 10

Overall NW Natural’s response to this comment is confusing. NW Natural did not provide the requested information regarding the depth of burial, instead indicating the depth of burial is not critical as long as the cable is embedded. In addition, it is unclear what NW Natural is referring to by an “extended period of inactivity (two or more months)” and performance of a “pre-measurement check.” There appears to be information about conducting the DTS survey and evaluating potential data irregularities that NW Natural should provide. In the absence of clarifying information from NW Natural, the Work Plan should be revised to include a sensitivity evaluation to assess the influence of the depth of cable burial on data collection. The evaluation would involve placing the cable on and within sediment at varying depths, measuring temperature, and assessing the differences in values.

EPA Comment 11—proposed DTS Test Investigation, pages 3 – 4

NW Natural should include more information on how the DTS testing will be orchestrated and integrated with ongoing HC&C system testing. Example questions that should be addressed include:

- a. Will the DTS investigation be scheduled to collect data before, during, and after a particular HC&C system testing phase?
- b. Is there a plan to integrate the DTS with the HC&C test results, and if so, how will this be done?

c. Will data collected from the DTS investigation be used to calibrate the groundwater model being developed to simulate the HC&C system? Note: This information and its application to model calibration are currently information not included in the Revised Final Hydraulic Source Control and Containment System Groundwater Model Update Report.

NW Natural Response to Comment 11

As discussed in response to Comment 9, initial DTS measurements will be performed while the HC&C system is turned off. DTS measurements would then be collected during operation of the HC&C system. The specific sequencing and durations for DTS data collection during HC&C system shut-down would be determined following cable deployment based on the status of the HC&C testing schedule at that time.

The Work Plan was revised to state that DTS data collection will initially occur during HC&C system shut-down and subsequently during system operation.

EPA Response to NW Natural Response to Comment 11

See EPA response to Comment 9 above. Please also address the questions posed in the three items above even if unknown at this time.

EPA Comment 12—Proposed DTS Test Investigation, Pages 3 – 4

EPA understands that the flux of groundwater discharge to and from the river at the Gasco site is dynamic and contingent upon groundwater recharge and river stages. EPA also recognizes the value of performing a test of the DTS system to understand its applicability for characterizing groundwater seepage offshore from the Gasco site. That said, EPA notes that more than one test of the DTS system will be necessary, particularly at a time of year that includes a high head differential data point (e.g., when upland groundwater heads are high and river stage is at seasonal low) to validate its use for verifying groundwater model results in offshore areas and potential cap design purposes. Periods of the year that seem appropriate to consider include spring (highest river stage as well as high water table), late spring/early summer (falling river stage and high water table), and late summer (lowest river stage and low water table).

NW Natural Response to Comment 12

As discussed in the Work Plan, if the results of the focused investigation demonstrate that the DTS technology will effectively provide the data needed for remedial design evaluations then specific additional investigation activities may be proposed at a later date. These activities may include performing DTS data collection during a variety of hydrologic conditions when the river and groundwater temperatures are sufficiently different to be accurately differentiated by the DTS technology. The rationale for additional proposed investigation, if any, will be presented in the focused investigation results report identified in the Work Plan. No revisions were made to the Work Plan based on this EPA comment.

EPA Response to NW Natural Response to Comment 12

Response is acceptable. See also EPA response to Comment 3 regarding EPA's understanding of the project report and EPA response to Comment 8 regarding temperature measurements.

EPA Comment 13—Proposed DTS Test Investigation, Page 3 – 4

Figure 3 indicates the DTS technology will be used to assess groundwater discharge/recharge in an area approximately 300-feet long by 150-feet wide along the southern shoreline of the Gasco site. The Work Plan indicates that the survey area includes the locations of two seepage meters (i.e., GS-B7SM and GCSEEP 7F). However, Figure 3 of the Work Plan shows that only GS-B7SM is within the actual survey area. This observation should be included in the Work Plan.

NW Natural Response to Comment 13

As noted in the response to Comment 4, the reference to location GCSEEP 7F in the Work Plan should have been GCSEEP 7B. The Work Plan was revised to incorporate the correct seepage meter locations.

EPA Response to NW Natural Response to Comment 13

Response is acceptable.

EPA Comment 14—Figure 2

NW Natural should explain in the text why the P7 well cluster is considered relevant for representing groundwater temperature discharging from the Gasco site and if there are other wells on the site that show more variation in groundwater temperature. Accordingly, NW Natural should explain the significance the underlying assumption that groundwater temperatures are consistently stable as shown for the P7 cluster is to the DTS analysis and resulting conclusions. To clarify: NW Natural should explain how potential groundwater temperature variation (if seen) impacts/biases the evaluation of the DTS data and the conclusions drawn from it.

NW Natural Response to Comment 14

Data from the PZ7 cluster were used for comparison to surface water temperatures in Figure 2 because these piezometers are the closest to the focused investigation area. Temperature data from other wells or piezometers in the uplands or nearshore at the Gasco Sediments Site could also have been usable for this purpose, because the groundwater temperature is generally consistent across the Site. Another cluster of piezometers (PZ9) was recently installed near the focused investigation area.

The Work Plan was revised to include the PZ7 and PZ9 piezometers on Figure 3.

EPA Response to NW Natural Response to Comment 14

Response is acceptable. EPA requests that information to support the statement that groundwater temperature is generally consistent across the Site be provided in the focused investigation results report.

EPA Comment 15—Figure 3

NW Natural should include the location of the P7 well cluster on this figure to show where these wells are in relation to the proposed DTS cable placement and where temperature data collection will occur.

NW Natural Response to Comment 15

The Work Plan was revised to include the PZ7 and PZ9 piezometers on Figure 3.

EPA Response to NW Natural Response to Comment 15

Response is acceptable.